Proposal
to

[redacted] 25X1

for

EVALUATION OF NOISELESS DRILLING METHODS

AND

DEVELOPMENT OF MOST PROMISING METHOD

Proposal No. E-163
1 July 1955

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PROPOSAL FOR

EVALUATION OF NOISELESS DRILLING METHODS

AND

DEVELOPMENT OF MOST PROMISING METHOD

I. PROBLEM: A drilling method is required that would permit the drilling of holes in masonry walls without annoying occupants on the other side of the wall or drawing attention to the fact that drilling is being done. Although specifications have not been written, certain foreseen requirements and desirable features of equipment and methods follow:

A. Walls that may be encountered may be of stone, brick, or cement.

B. Drilling depth may be as great as 30 inches.

C. Drilling noises should be inaudible on the wall opposite the side on which the drilling is being done and scarcely audible at the drilling location.

D. Drilling control must be such that there is absolutely no chance of the hole going through the wall to the other side or giving any indication on the other side that drilling is being done.

E. The hole size is assumed to be 3/8 inch, although a larger access could be obtained by combining a number of 3/8 inch holes.

F. Walls in question will be located in such places as hotels, apartment houses, and inhabited business establishments.

G. Power sources would be available, but electric power available would be limited to that available from the usual convenience outlet.

H. Equipment should be light in weight, portable, and capable of being transported to location by a single man in containers the size of ordinary suitcases. One or more trips could be required to transport the entire equipment.

I. Drilling time should be fairly rapid. An acceptable speed would be possibly two to three hours for an access hole.

J. Litter and waste should not mar or in any way damage the floor or wall on the drilling side except for the hole itself.

II. DISCUSSION: A number of drilling methods should be considered, evaluated, and tried, before any attempt is made toward developing the equipment and techniques of a workable system. As a preliminary approach to the problem, a number of methods offering promise are considered as follows:

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A. <u>The Ultra-Sonic Drill</u>: Sound waves above the audible range would be concentrated in a small area on the wall to disintegrate the masonry structure in that area.

1. Attractive features:

a. Noise transmitted from the hole should be extremely small, if not non-existent.

b. Very accurate control should be possible.

2. Possible drawbacks:

a. Power requirements excessive.

b. Size and weight of equipment undesirable.

B. <u>The Ultra-Sonic Drill Combined with Chemical Solvents</u>: Ultra-sonic energy acts as a catalyst on a number of chemical reactions. It may be very practical to use certain acids or corrosives in combination with or alternately with ultra-sonic energy. The speed-up of the particular chemical reaction might permit rapid controlled penetration of the masonry.

1. Attractive features:

a. Low noise emission.

b. Reduction in power requirement of ultra-sonic equipment.

2. Possible drawbacks:

a. Different chemicals could be required for different types of masonry.

b. Hole size and depth control may be difficult.

c. Careless use of chemicals could damage wall, floor, or furnishings of a room.

C. <u>Heat</u>: Certain types of masonry walls could possibly be drilled by the application of extreme heat. A blowpipe in conjunction with a candle or gas flame could be used to apply such heat. The process could be speeded up by the use of an oxygen jet. The size and depth of hole for a particular wall material would determine the required oxygen. Features thatwould have to be examined include:

1. Attractive features:

a. Equipment small in size and easily transported.

b. Burning should be low in noise output.

2. Possible drawbacks:

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a. System probably not effective on all types of walls.

b. Control near surface of other wall side may be difficult.

D. Heating and Cooling: For walls which include certain types of igneous rock including some limestone and sandstone, formations can be chipped away by methods similar to that used by the Indians in making flint arrows; i.e., heating a point to a high temperature and then cooling it rapidly with moisture or some other cooling agent. Alternate cooling and heating will chip off small particles of stone.

1. Attractive features:

a. Equipment small in size.

b. Method relatively noiseless.

2. Possible drawbacks:

a. Method not applicable to all types of masonry.

b. Control probably would become more difficult as hole depth increased.

c. Drilling would be relatively slow.

E. Electronic Arc: An electronic arc operating in the ultra-sonic area, for instance, the ionophone, might provide a relatively silent means of applying ultra-sonic energy and electronic heat at the same time.

1. Attractive features:

a. Possible rapid drilling.

b. Relatively silent drilling.

2. Possible drawbacks:

a. Equipment could be bulky.

b. Amount of power required excessive.

c. It might be difficult to keep the arc in contact with the bottom of the hole as the wall is penetrated.

F. Slow Speed Drill: On certain types of stone, this probably would be one of the most practical types of drilling. A multiple carboloy head operating at very low speeds and small chip sizes should be extremely silent. Of course, the driving motor would have to be encased so as to deaden sound. It is possible that this method could be made effective on all types of walls, though it is obvious that soft stones would offer the greatest possibility of success.

1. Attractive features:

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a. Equipment light and portable.

b. Method could be made relatively noiseless.

c. Power requirements small.

2. Possible drawbacks:

a. Method would work best on soft stones.

b. Considerable time would be required to drill hole.

G. High Speed Drill: Sounds above 4,500 or 5,000 cycles are not readily transmitted by masonry walls. If a high speed drill were used it should not be difficult to keep the amplitude of these higher frequency sounds down below the threshold of audibility on the other side of the wall. Therefore, for this method to be successful, a drill point and driving speed would have to be used that would keep the chipping rate above 5,000 cycles. As with the slow speed drill, the driving motor would have to be encased in sound absorbing material.

1. Attractive features:

a. Equipment light and portable.

b. Power requirements small.

c. Cutting rate fast.

d. Sounds below audible level on opposite side of wall.

2. Possible drawbacks:

a. Speed of drill would have to be very high -- possibly unattainable.

b. Bit would become very hot -- a method of cooling or an exchange of bits would be necessary.

c. Chances of detection would become greater as hole became deeper.

H. Abrasives in Air: Sand blasting is normally a rather noisy and dirty method of erosion, but it may be practical to use this system with a concentric type of unit for which the sand blasting unit is the center tube operating at a velocity and with a particle size that would be relatively soundless. The outside tube would be held at several atmospheres pressure lower and would pass off spent abrasive and air.

1. Attractive features:

a. Should work on all types of walls.

b. Relatively noiseless.

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2. Possible drawbacks:

a. Slow cutting speed.

b. Equipment bulky.

I. Abrasives in Liquid: The use of abrasives in certain liquid carriers or propellants is a relatively new method, but has been developed recently for cutting in certain types of very hard materials. It appears practical that such a system could be designed for the drilling problem at hand.

1. Attractive features:

a. Hard materials cut easily and quickly.

b. Relatively noiseless cutting.

2. Possible drawbacks:

a. Difficulty of keeping area surrounding drilling clean.

b. Large amount of abrasive material required for a given hole.

c. Seepage may prevent its use on porous types of material.

J. Liquid Forced into Rock Pores: Certain types of stone structures are porous and will absorb moisture to a certain extent. It may be practical for certain medium hard and hard stones to force some liquid under pressure into a limited area of the stone. This portion of the stone could then be popped off by rapid applications of heat or cold.

1. Attractive features:

a. Equipment small.

b. Method noiseless.

2. Possible drawbacks:

a. Limited application.

b. Drilling rate slow.

c. Control for deep holes becomes difficult.

III. RESEARCH AND APPLICATION WORK TO BE ACCOMPLISHED: The work to be accomplished to bring about the best solution to the problem can best be discussed in terms of three phases:

A. Phase I - Preliminary Investigation: As the most efficient start on a problem of this kind, some time should be devoted at the beginning of the project to examining the literature, checking with manufacturers, and in some cases actually viewing equipment at the manufacturers plant. This type of check would more clearly define advantages and possible

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problems as discussed in Section II. No doubt, this preliminary investigation would uncover new methods and eliminate some of the possibilities mentioned in Section II. Approximately one man-month should be used in this manner. Part of this time would be spread over the entire project.

B. Phase II - Equipment Testing: This phase of the project would be devoted to the actual testing of existing commercial equipments for all methods appearing feasible from the preliminary investigation. Minor modifications would be made on obtainable equipments to adapt them for the special tests. Equipment for these tests would be borrowed or rented where practical and, if not practical, would be purchased.

The results of these tests would be evaluated and one or more methods would be chosen for development. While it is possible that a single method may answer all needs, it is likely that two or more methods may be necessary to meet all conditions. Approximately four man-months would be required on this phase of the project.

C. Phase III - Equipment Development: The method or methods selected in Phase II would be explored further and equipment developed for field use. It is visualized that for the most part this work would involve modifying and adapting commercially available parts and equipment.

IV. CONCLUSIONS: In summary, [redacted] proposes to: 25X1

A. Examine all possible solutions to the problem.

B. Make tests to determine the limitations of the best of most likely methods.

C. Develop and deliver as a useable tool a complete set of field equipment. This field equipment may involve one or more methods. It is understandable that the final equipment may not answer all the desirable features as set forth in the problem, but it will be the best possible equipment obtainable within the scope of the project.

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V. TIME AND COST ESTIMATES: The following cost estimate is based on a project duration of one year from the date of contract.

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F. Total Cost of Project $ 47,785.00

VI. CONTRACTOR QUALIFICATIONS: [redacted] has for a number of years worked on methods of drilling for the petroleum industry, having examined a large number of different ideas in this field. Recently, a brief study of unorthodox machining methods has been made with [redacted] funds. The Institute has the combined services of mechanical and materials engineers, chemical engineers, and physicists needed to evaluate the variety of possible problem solutions. 25X1 25X1

[redacted] has ready access to geophysical, geological, and related data developed by the petroleum industry, which should be most useful in phases of the proposed work. 25X1

The close relationship of this project with the [redacted] present Task 15 is obvious and considerable advantage could be gained by the close cooperation and mutual development of these two projects. 25X1

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